



SITE QUALITY ASSURANCE PROJECT PLAN

CAMDEN MUNICIPAL WELLS
CITY OF CAMDEN AND PENNSAUKEN TOWNSHIP, NEW JERSEY

Prepared by

Superfund Technical Assessment and Response Team
Roy F. Weston, Inc.
Federal Programs Division
Edison, New Jersey 08837


Prepared for

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Region II
New York, New York 10007

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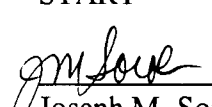
Approved by:

START


Richard Flack, START
Project Manager

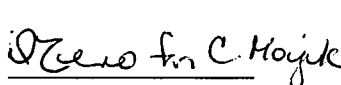
Date: 6/8/00

START


Joseph M. Soroka, START
Quality Assurance Officer

Date: 6/8/00

EPA


Cathy Moyik
Task Monitor

Date: 6/12/00

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The following elements are provided in the START Generic Quality Assurance Project Plan (QAPP) and are included by reference:

QA REPORTS TO MANAGEMENT
 PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES
 RECORDS MANAGEMENT SYSTEM
 LOGBOOK PROGRAM
 QUALITY-RELATED DOCUMENTS
 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

LIST OF ATTACHMENTS

ATTACHMENT A: Site Location Map

ATTACHMENT B: Proposed Sample Location Map

ATTACHMENT C: EPA/WESTON Sampling SOPs

ATTACHMENT D: PREScore Scoresheets

1.0 INTRODUCTION

Presented herein is the site Quality Assurance Project Plan (QAPP) for the sampling event to be conducted at the Camden Municipal Wells by the Region II Superfund Technical Assessment and Response Team (START). The site QAPP has been developed at the request of the United States Environmental Protection Agency (U.S. EPA) in accordance with the START Generic Quality Assurance Project Plan (QAPP).

This plan is based on information currently available and may be modified on site in light of acquired information. All deviations from the QAPP will be noted in the site logbook and Sampling Trip Report.

2.0 PROJECT DESCRIPTION

The City of Camden, New Jersey is located in the southwest region of New Jersey, directly across the river from Philadelphia, Pennsylvania. The 1990 census population of the City is approximately 87,500. The City of Camden Municipal Wells provide approximately 50,000 residents with over 2.34 billion gallons of water per year (1988 figures). City-owned wells are located in Pennsauken Township and within the City of Camden. The wells occupy 22 separate Block and Lots in Pennsauken Township (Attachment A) and Block 1279, Lots 1 and 5 in Camden City. The City of Camden has owned the land the wells are located on since at least the 1930s.

Prior to the 1930s, Camden owned and operated approximately 100 shallow wells in and around the Morris Wellfield in Pennsauken Township. Past information on these wells is limited, but they were eventually replaced by the current, deeper municipal wells. Because the aquifer from which Camden obtains its raw water contains numerous organic and inorganic pollutants, the City has closed wells, drilled new wells, and provided water treatment. Other municipal wells in the same aquifer near Camden's wells have also shown contamination problems in the past. In 1984, Merchantville-Pennsauken's National Highway Well #1 was closed due to high levels of mercury and volatile organic compounds (VOCs). With the use of air strippers, Well #1 has resumed pumping potable water.

Currently the City has 14 operable wells in four wellfields. Water withdrawal within the city boundaries includes two wells at the Parkside Wellfield. City-owned wellfields in the neighboring Township of Pennsauken include Morris (eleven wells) and Delair (one well).

The two wells that are in the Parkside Wellfield (#17 and #18) are located within the city limits just south of the Cooper River. Raw water from the Parkside Wells contains high levels of carbon

dioxide, moderately high levels of iron and manganese, and various levels of VOCs including trichloroethene (TCE), tetrachloroethene (PCE), carbon tetrachloride, and 1,2-dichloroethane.

The Morris Wellfield is located in Pennsauken Township, Camden County and is bounded to the west by the Delaware River, to the south by the Betsy Ross Bridge, to the east by Penn Central Railroad tracks and to the north by Pennsauken Creek. With its eleven operable wells the Morris Wellfield is the City of Camden's most productive wellfield, producing approximately 18 mgd.

Recent sampling of Morris Wellfield raw water by the NJDEP Division of Water Resources (DWR) Bureau of Southern Enforcement has shown the presence of contaminants at concentrations below Maximum Contaminant Levels (MCL) for drinking water in all wells. The Morris Wellfield has had a history of high concentrations of iron and manganese, and low concentrations of VOCs including TCE, PCE, and 1,2-dichloroethane. Phenols have also been detected in some of the wells. Several wells in the Morris Wellfield were abandoned as a result of high iron and manganese content.

The Delair Wellfield, also located in Pennsauken Township, is several hundred feet south of the Betsy Ross Bridge and is bordered by the Delaware River to the west. The wellfield consists of one operable well. The quality of water from the Delair Wellfield is slightly higher than that of the other wellfields. Contaminants of concern include iron, manganese, and low concentrations of VOCs.

Due to the close proximity of the Morris and Delair Wellfields and the fact that the two wellfields share the same water treatment facility (Morris-Delair Water Treatment Plant), they have been referred to in the literature as the Morris-Delair Wellfield. The Morris and Delair Wellfields produce approximately two-thirds of the city's potable water.

A site location map is presented in Attachment A. The locations of the wells in the Morris and Delair Wellfields are shown in Figure B1 in Attachment B. The locations of the Parkside wells and the City wells are presented in Figure B2 in Attachment B.

2.1 Evaluation of Existing Data

Existing data from groundwater samples collected by various parties indicates low levels of VOCs and metals; however, recent sampling data is not available for the site.

2.2 Hazard Assessment

An evaluation of previous groundwater data for the Camden Wells site indicates the likelihood of establishing a release to groundwater is high. Therefore, the groundwater pathway is currently being evaluated to determine whether remedial action under CERCLA is warranted.

Sources - The Camden Wells site is affected by a regional groundwater plume (unallocated source). The exact source of this contamination is unknown.

Groundwater Pathway - There is a high likelihood that an observed release of contaminants to groundwater has occurred. Analytical data from historic well samples collected by various parties indicate the presence of VOCs and metals in groundwater. There is also a high likelihood that the public supply wells that make up the site have been affected by this contamination. Some public supply wells have been closed or have been fitted with treatment systems due to contamination.

Surface Water Pathway - There is no surface water pathway associated with the site.

Soil Exposure Pathway - There is no soil exposure pathway associated with the site.

Air Pathway - There is no air pathway associated with the site.

2.3 Sensitivity Analysis - Camden Wells

A sensitivity analysis was performed to determine the impact of certain variables on the overall HRS scoring. The groundwater pathway was the only pathway evaluated, since no other pathways exist for the site. Therefore, START will only collect groundwater samples.

Historical sampling data indicate that VOCs and metals are a regional problem in the area of the site. The Camden Wells supply over 50,000 people with drinking water. The sensitivity analysis currently indicates that due to the high number of groundwater pathway targets, the presence of actual contamination increases the overall site score to greater than 28.5. However, current analytical data regarding the groundwater pathway are unavailable. PREScore sheets, showing a Level II actual contamination of one of the wells using TCE and PCE, are presented in attachment D.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The EPA Task Monitor (TM), Cathy Moyik, will provide overall direction to the staff concerning project sampling needs, objectives, and schedule. The Project Manager (PM), Richard Flack, will be the primary point of contact with the TM. The PM is responsible for the development and completion of the Sampling QA/QC Plan, project team organization, and supervision of all project tasks, including reporting and deliverables. The Site QC Coordinator will be responsible for ensuring field adherence to the Sampling QA/QC Plan and recording of any deviations. The START Analytical Services Coordinator, Smita Sumbaly, will be the primary project team site contact with the EPA Contract Laboratory Program (CLP) coordinator and the subcontracted laboratory if necessary.

Analysis for Target Compound List (TCL) organics, and Target Analyte List (TAL) inorganics, will be performed through the EPA Contract Laboratory Program (CLP). START personnel will transfer custody of the samples for shipment to the appropriate laboratories. CLP data will be validated by EPA Region II prior to receipt at START.

The following sampling personnel will work on this project:

<u>Personnel</u>	<u>Responsibility</u>
Rich Flack	Project Manager, Field Coordinator
Tom Varner	Sample Management Officer (SMO)/QC Coordinator
Mike Mohn	Sampler, Site Health and Safety Officer

The following laboratories will provide the following analyses:

<u>Lab Name/Location</u>	<u>Sample/Type</u>	<u>Parameters</u>
CLP Lab - To be determined	Aqueous	TCL Organics - 14 day turnaround
CLP Lab - To be determined	Aqueous	TAL Inorganics - 14 day turnaround
Private Lab - To be determined	Aqueous	Chromium VI - 24 hour turnaround

4.0 DATA-USE OBJECTIVES

The objective of this sampling event is to assess the quality of site groundwater and to provide an extent of groundwater contamination. Results will be used with an Environmental Data Resources Report or other background information to identify potential sources for any detected contaminants. Any identified sources will be evaluated for inclusion on the NPL individually. Data will be compared to drinking water Maximum Contaminant Levels (MCLs). If MCLs are exceeded, the removal program will be notified.

4.1 Quality Assurance Objectives

The overall Quality Assurance (QA) objective for chemical measurement data associated with this sampling event is to provide analytical results that are legally defensible in a court of law. The QA program will incorporate Quality Control (QC) procedures for field sampling, chain of custody, laboratory analyses, and reporting to assure generation of sound analytical results.

The EPA Task Monitor (TM) has specified the use of the CLP for the TCL organic and TAL inorganic analyses for this project (i.e. critical level of QA [QA-2]). Details of this QA level are provided below.

The following requirements apply to the respective QA Objectives and parameters identified.

The QA Protocols for a Level 2 QA objective sampling event are applicable to all sample matrices and include:

1. Sample documentation in the form of field logbooks, appropriate field data sheets, and chain of custody records (chain of custody records are optional for field screening locations).
2. Calibration of all monitoring and/or field-portable analytical equipment prior to collection and analyses of samples with results and/or performance check procedures/methods summarized and documented in a field, personal, and/or instrument log notebook.
3. Field or laboratory determined method detection limits (MDLs) will be recorded along with corresponding analytical sample results, where appropriate.
4. Analytical holding times as determined from the time of sample collection through analysis. These will be documented in the field logbook or by the laboratory in the final data deliverable package.

5. Initial and continuous instrument calibration data.
6. QC blank results (rinsate, trip, method, preparation, instrument, etc.), as applicable.
7. Collection and analysis of blind field duplicate and MS/MSD QC samples to provide a quantitative measure of the analytical precision and accuracy, as applicable.
8. Use of the following QC procedure for QC analyses and data validation:

Definitive identification - confirm the identification of analytes on 100% of the "critical" samples, via an EPA-approved method; provide documentation such as gas chromatograms, mass spectra, etc.

The objective of this project/event applies to the following parameters:

Table 1: Quality Assurance Objectives

QA Parameters	Matrix	Intended Use of Data	QA Objective
TCL organics (VOCs, SVOCs, Pest/PCBs)	Aqueous	Verify presence or absence of hazardous material.	QA-2 (CLP)
TAL inorganics (Metals)	Aqueous	Verify presence or absence of hazardous material.	QA-2 (CLP)
Chromium VI	Aqueous	Verify presence or absence of hazardous material	QA-2 (Private)

A Field Sampling Summary is attached in Table 2 and a QA/QC Analysis and Objectives Summary is attached in Table 3. Section 5.1, Sampling Design, provides information on analyses to be performed on the individual soil samples.

Table 2: Field Sampling Summary

Analytical Parameters	Matrix	Container Size	Preservative	Holding Time	Subtotal Samples	Trip Blanks	Rinsate Blanks ²	Duplicate Samples	MS/MSD Samples	Total Field Samples
TAL Metals	Aqueous	1 x 1-L polyethylene bottle	Cool to 4° C, HNO ₃ to pH<2	6 months to analyze Hg - 30 days	18	NA	2	2	2	22
Chromium VI	Aqueous	1 x 1-L polyethylene bottle	Cool to 4° C	24 hours	18	NA	2	2	2	22
TCL VOCs	Aqueous	2 x 40 - ml glass vials w/ teflon septum caps	Cool to 4° C, HCl to pH<2	7 days, unpreserved 14 days, preserved	18	3	2	2	2	25
TCL BNA/Pesticides/PCBs	Aqueous	4 x 1 - L amber glass bottles	Cool to 4° C	7 days to extract 40 days to analyze	18	NA	2	2	2	22

¹ Holding time from date of sampling.

² Only required if non-dedicated sampling equipment to be used. NR - not required, dedicated sampling equipment to be used.

NA Not Applicable

Table 3: QA/QC Analysis and Objectives Summary

Analytical Parameters	Matrix	Analytical Method Reference	QA/QC Quantitation Limits	QA Objective
TCL organics	Aqueous	CLP OLMO 4.2	As per method	QA-2
Chromium VI	Aqueous	EPA 600/218.4, 218.5	As per method	QA-2
TAL inorganics	Aqueous	CLP ILMO 4.1	As per method	QA-2

Note: CLP-format deliverables required for all data packages.

5.0 APPROACH AND SAMPLING PROCEDURES

During the week of 6 June 2000, an initial inspection will be performed by START personnel in order to ensure that all of the municipal water supply wells are accessible and to determine the sampling method and equipment that will be required. Groundwater sampling activities will then be conducted during the week of 29 May 2000 at the Camden Municipal Wells.

5.1 Sampling Design

Sampling activities at the site will consist of ground water sample collection from both operating and non-operating municipal wells. Ground water samples will be collected from a total of 18 well locations. Ground water samples will be collected from the Parkside Wellfield at three locations (Well #13, Well #17, and Well #18). Delair Wells #1, #2, and #3 will be sampled. Morris Wells #4, #6, #12, #13, #7, #8, #10, #1, #2, #3, #14, and #11 will be sampled. Ground water samples will be collected from additional water supply wells if required.

MS/MSD samples will be collected at one location. Duplicate sampling will be performed at one location. One trip blank will be collected as needed for inclusion with each batch of samples collected and shipped (generally on a daily basis). If required, a rinsate blank will be collected.

5.2 Schedule of Activities

Proposed Start Date	Activity	End Date
Week of 6 June 2000	Site Reconnaissance	Week of 6 June 2000
Week of 13 June 2000	Ground Water Sampling	Week of 13 June 2000

5.3 Sampling Equipment

Ground water samples will be collected directly into the appropriate sample bottles. Thirteen of the wells are in active use and are equipped with sample ports prior to any treatment. The sampling port will be purged for ten minutes prior to sampling. For the remaining five wells, Grundfos lowflow sampling pumps will be used to obtain samples according to EPA's Low Flow Groundwater SOP. Consequently, rinsate samples will then be collected (1 rinsate per day per sampling method).

5.4 Sample Identification System

Each sample collected by START will be designated by a code that will identify the site. The code will be a site-specific project tracking number. The code for the Camden Municipal Wells is 6532. The media type will follow the numeric code. A hyphen will separate the site code and media type.

Specific media types are as follows:

GW-Ground Water

RB - Rinsate Blank

TB - Trip Blank

After the media type, the sequential sample numbers will be listed. A duplicate sample will be identified in the same manner as other samples and will be distinguished and documented in the field logbook.

5.5 Standard Operating Procedures (SOPs)

5.5.1 Sample Documentation

All sample documents will be completed legibly, in ink. Any corrections or revisions will be made by lining through the incorrect entry and by initialing the error.

FIELD LOGBOOK

The field logbook is essentially a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed in the writer's absence. All entries will be dated and signed by the individuals making the entries, and should include (at a minimum) the following:

- 1.Site name and project number.
- 2.Name(s) of personnel on site.
- 3.Dates and times of all entries (military time preferred).
- 4.Descriptions of all site activities, site entry and exit times.
- 5.Noteworthy events and discussions.
- 6.Weather conditions.
- 7.Site observations.
- 8.Sample and sample location identification and description.
- 9.Subcontractor information and names of on-site personnel.
- 10.Date and time of sample collections, along with chain of custody information.
- 11.Record of photographs.
- 12.Site sketches.

The description of the sample location will be noted in such a manner as to allow the reader to reproduce the location in the field at a later date.

SAMPLE LABELS

Sample labels will clearly identify the particular sample, and should include the following:

1. Site/project number.
2. Sample identification number.
3. CLP number.
4. Sample collection date and time.
5. Designation of sample (grab or composite).
6. Sample preservation.
7. Analytical parameters.
8. Name of sampler.

Sample labels will be written in indelible ink and securely affixed to the sample container. Tie-on labels can be used if properly secured.

CUSTODY SEALS

Custody seals demonstrate that a sample container has not been tampered with, or opened. The individual in possession of the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook.

5.5.2 Sampling SOPs

The following Sampling SOPs will be used for this project:

Decontamination

All stainless steel equipment involved in field sampling activities will be decontaminated in accordance to EPA/ERT SOP #2006 prior to and subsequent to sampling. Decontamination of sampling equipment will be kept to a minimum in the field; whenever possible dedicated sampling equipment will be used. Decontamination of sampling equipment, including stainless steel augurs and bowls, will be conducted as follows:

- 1) Alconox detergent and potable water scrub,
- 2) Potable water rinse,
- 3) A 10% nitric acid rinse (ultra pure grade) when sampling for inorganic parameters,
- 4) Distilled or potable water rinse,
- 5) An acetone rinse,
- 6) Deionized water rinse.

- 7) Air dry (sufficient time will be allowed for the equipment to completely dry), and
- 8) Wrap or cover exposed ends of sampling equipment with aluminum foil (shiny side out) for transport and handling.

GROUND WATER SAMPLING

Ground water samples being collected with a Grundfos submersible pump will be collected in accordance with guidelines outlined in EPA Low Stress Groundwater Well Sampling SOP #2007 (Attachment C). Ground water samples being collected directly from sample ports will be collected according to the guidelines outlined in the WESTON Standard Practices Manual, Potable Water Sampling (Attachment C).

5.5.3 Sample Handling and Shipment

Samples will be packaged and shipped according to the U.S. EPA User's Guide to the Contract Laboratory Program (January 1991). Chain of custody forms, sample labels, custody seals, and other sample documents will be completed as specified in the above-referenced manual. All entries will be made in permanent ink. If errors are made when completing any of these forms, the error will be crossed out with a single line, initialed, and dated by the sampler. Each environmental sample will be properly identified and sealed in a polyethylene bag. The bag shall then be placed in a plastic cooler that has also been lined with a large polyethylene bag. When required, samples shall be packed with sufficient ice (sealed in polyethylene bags) to cool the samples to 4°C. Sufficient noncombustible, adsorbent cushioning material shall be placed in the cooler so as to minimize the possibility of container breakage. All sample documents will be sealed in a plastic bag and affixed to the underside of each cooler lid. The large plastic bag shall then be sealed and the container closed. The lid will be sealed and custody seals and strapping tape shall then be affixed to the outer packaging so that any sign of tampering is easily visible. All packaging will conform to International Air Transport Association (IATA) regulations for overnight carriers. Sample shipment will conform to Roy F. Weston, Inc., Guidelines for Classifying Field Sample Shipments and the most current IATA Dangerous Goods Regulations. All samples will either be hand-delivered or shipped via common carriers to the laboratory within 24 hours of collection. Information relating to the shipment of samples, including the airbill number, sample quantity, and the sample types, will be reported to the USEPA Sample Management Office on the day of or morning after shipment.

5.6 Sample Containers

Sample bottles will meet all guidelines specified in OSWER Directive 9240.0-05A, Specifications and Guidance for Contaminant Free Sample Containers (July 1989). The required sample containers are listed in Table 2.

5.7 Disposal of PPE and contaminated sampling materials

Investigation derived wastes (IDW) include personal protective equipment (PPE) and disposable sampling equipment (DSE). All PPE and DSE will be decontaminated and disposed as dry industrial waste.

6.0 SAMPLE CUSTODY

The SMO will prepare and maintain appropriate chain of custody records from the time the sample is delivered (to the SMO) to its final deposition. USEPA CLP Organic and Inorganic Traffic Reports and Chain of Custody Records must be used for samples analyzed through the CLP. Every transfer of custody must be noted and signed for, and a copy of this record kept by each individual who has signed. When samples (or groups of samples) are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. Specific information regarding custody of the samples projected to be collected on the weekend will be noted in the field logbook.

The chain of custody record should include (at minimum) the following:

1. Sample identification number and CLP No(s), as applicable.
2. Sample information (e.g., matrix, concentration, type, preservation).
3. Analysis(es).
4. Sample date and time.
5. Name(s) and signature(s) of sampler(s).
6. Signature(s) of any individual(s) with control over samples.

Additionally, the CLP Case No., Site Name, Location, CERCLIS ID No., Region No., Laboratory, Carrier, and Airbill No. must be reported on the chain of custody reports for all samples analyzed through the CLP. A separate chain of custody form must accompany each cooler for each daily shipment. The chain of custody form must address all samples in that cooler, but not address samples in any other cooler. This practice maintains the chain of custody for all samples in case of mis-shipment.

7.0 FIELD INSTRUMENT CALIBRATION AND PREVENTIVE MAINTENANCE

The sampling team is responsible for assuring that a calibration/maintenance log will be brought into the field and maintained for each measuring device. Each log will include at a minimum, where applicable:

1. name of device and/or instrument calibrated
2. device/instrument serial and/or ID number
3. frequency of calibration
4. date of calibration

5. results of calibration
6. name of person performing the calibration
7. identification of the calibrant (PID, FID, pH meter)

Equipment to be used each day will be calibrated prior to the commencement of daily activities.

8.0 ANALYTICAL METHODS

Analytical methods to be utilized in the analyses of samples collected during this sampling event are detailed in Table 3.

9.0 DATA REDUCTION, VALIDATION AND REPORTING

9.1 Deliverables

The START PM, Richard Flack, will maintain contact with the EPA TM, Cathy Moyik, to keep her informed about the technical and financial progress of this project. This communication will commence with the issuance of the work assignment and project scoping meeting. Activities under this project will be reported in status and trip reports and other deliverables (e.g., analytical reports, final reports) described herein. Activities will also be summarized in appropriate format for inclusion in monthly and annual reports.

The following deliverables will be provided under this project:

TRIP REPORT

A trip report will be prepared to provide a detailed accounting of what occurred during each sampling mobilization. The trip report will be prepared within one week of the last day of each sampling mobilization. Information will be provided on time of major events, dates, and personnel on site (including affiliations).

MAPS/FIGURES

Maps depicting site layout, contaminant source areas, and sample locations will be included in the trip report, as appropriate.

ANALYTICAL REPORT

An analytical report will be prepared for samples analyzed under this plan. Information regarding the analytical methods or procedures employed, sample results, QA/QC results, chain of custody documentation, laboratory correspondence and raw data will be provided within this deliverable.

DATA REVIEW

A review of the data generated under this plan will be undertaken. The assessment of data acceptability or useability will be provided separately, or as part of the analytical report.

9.2 Data Validation

Analytical results obtained through the CLP will be validated in accordance with the most current USEPA Region 2 data validation guidelines under a separate EPA contract.

Data generated under this QA/QC Sampling Plan will be evaluated according to criteria contained in the Removal Program Data Validation Procedures that accompany OSWER Directive number 9360.4-1 and in accordance with Region 2 guidelines.

Laboratory analytical results will be assessed by the data reviewer for compliance with precision, accuracy, completeness, representativeness, and sensitivity.

10.0 FIELD QA/QC CHECK SAMPLES AND FREQUENCY

This section details the Quality Assurance/Quality Control (QA/QC) requirements for field activities performed during the sampling effort.

QA/QC samples will include the collection of one field duplicate and one MS/MSD sample for each matrix (soil or aqueous) at a ratio of 1 per 20 samples (for QA-2 [e.g., CLP]). The analysis of CLP TCL/TAL parameters for the MS/MSD sample will involve the collection of triple sample volume for aqueous samples. The extra sample volume will be submitted to allow the laboratory to perform matrix spike sample analysis. This analysis provides information about the effect of sample matrix on digestion and measurement methodology. Field duplicate samples provide an indication of analytical variability and analytical error (e.g., reproducibility) and will not be identified to the laboratory.

A trip blank will be collected for events involving aqueous sampling for VOCs. A trip blank is an aliquot of deionized (DI) demonstrated analyte-free water which is prepared in the field prior to the initiation of field work and sealed in 40-mL glass vials with teflon-lined septum caps. Analytical results of the trip blank sample are utilized during sample data validation to determine if any cross contamination has occurred between samples during shipment/storage, or if on-site atmospheric contaminants are seeping into the sample vials. These sealed bottles will be placed in a plastic cooler and will accompany field personnel to the sampling locations.

The distilled DI water utilized for the trip blanks will be certified as such. A copy of this certificate will be kept on site and another in the site-specific project file. The criteria to be demonstrated as analyte-free will be consistent with that specified in the U.S. EPA Region II CERCLA Quality Assurance Manual (October 1989), and is as follows:

--
Purgeable organics < 10 ppb
Inorganics < CRDL

where the CRQL is represented by the Contract Required Quantitation Limit and the CRDL is represented by the Contract Required Detection Limit in the most recent CLP Statement of Work. For specific common laboratory contaminants such as methylene chloride, acetone, toluene, and 2-butanone, the allowable limits are three times the respective CRQLs.

Field Rinsate Blanks will be collected when non-dedicated sampling equipment is used. A field rinsate blank will consist of distilled DI, analyte-free water that has been poured over decontaminated sampling equipment. The field rinsate blank analytical results will be utilized in evaluation of potential cross contamination resulting from inadequate decontamination only if non-dedicated sampling equipment is used. The frequency of field rinsate blank collection is one blank per decontamination event per type of equipment, not to exceed more than one per day. Blanks will be collected for all parameters of interest (excluding physical parameters) and shipped with the samples collected the same day. Field rinsate blanks will be collected by Region II START.

Field rinsate blanks will be collected in accordance with the procedure listed below:

1. Decontaminate sampling equipment using the procedure specified in Section 5.5.2 of this plan.
2. Pour DI water over the sampling device and collect the rinsate in the appropriate sample containers.

11.0 SYSTEM AUDIT

The Field QA/QC Officer will observe sampling operations to ensure compliance with the QA/QC requirements of the project/sampling event.

12.0 CORRECTIVE ACTION

All provisions will be taken in the field and laboratory to ensure that any problems that may develop will be dealt with as quickly as possible to ensure the continuity of the project/sampling events. Any deviations from this sampling plan will be noted in the final report.

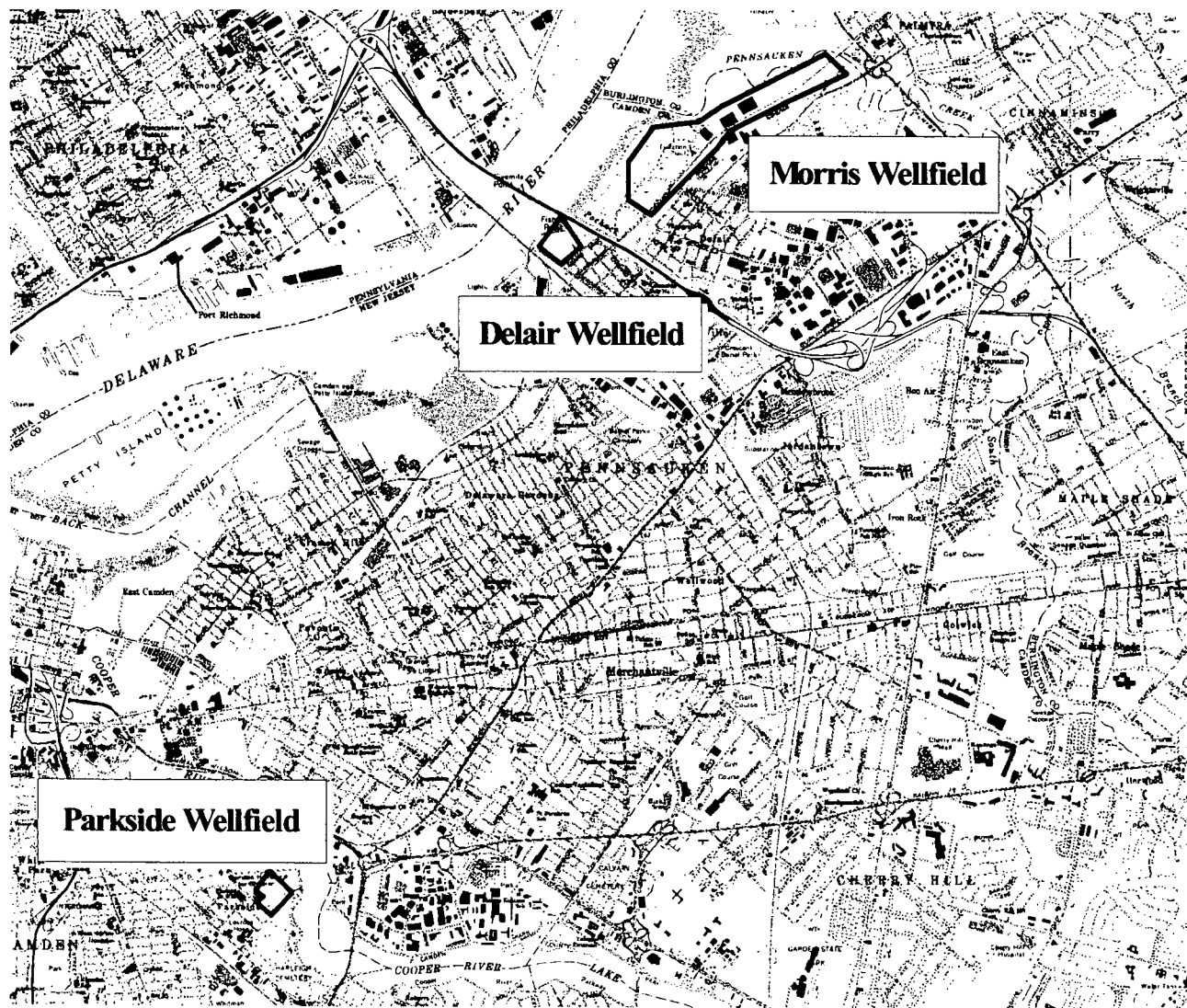
ATTACHMENT A
SITE LOCATION MAP



FEDERAL
PROGRAMS
DIVISION

Camden Municipal Wells Site
Camden, Camden Co., NJ

TDD No. 02-00-02-0008
Contract No. 68-W5-0019



U.S. Geological Survey
Topographical Map
Camden Quadrangle, 1967
Photorevised 1984



-  Parkside Wellfield
-  Morris Wellfield
-  Delair Wellfield

Figure A
Site Location Map

1" = Approximately 4000'

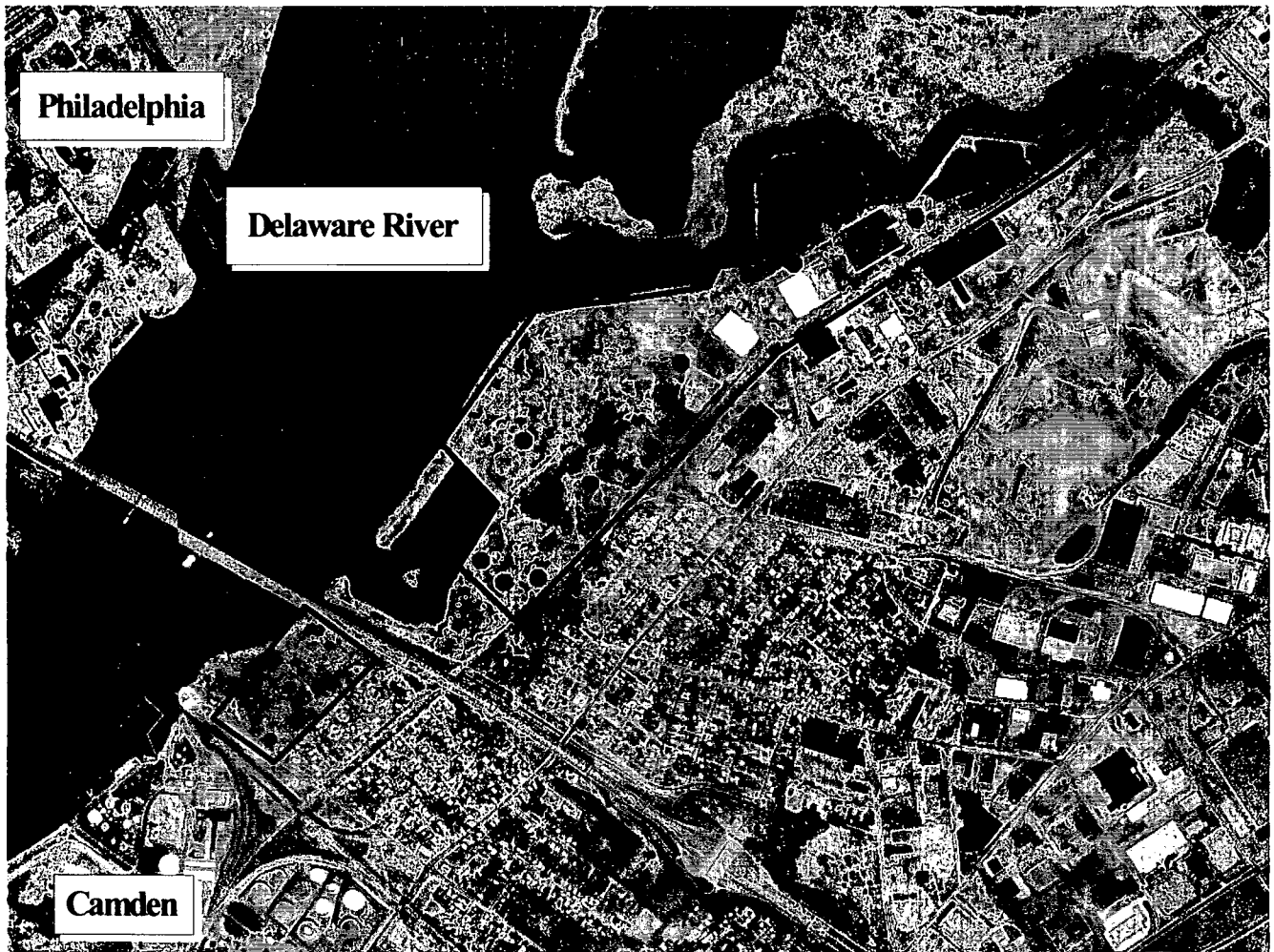
ATTACHMENT B

PROPOSED SAMPLE LOCATION MAPS



Camden Municipal Wells Site
Camden, Camden Co., NJ

TDD No. 02-00-02-0008
Contract No. 68-W5-0019



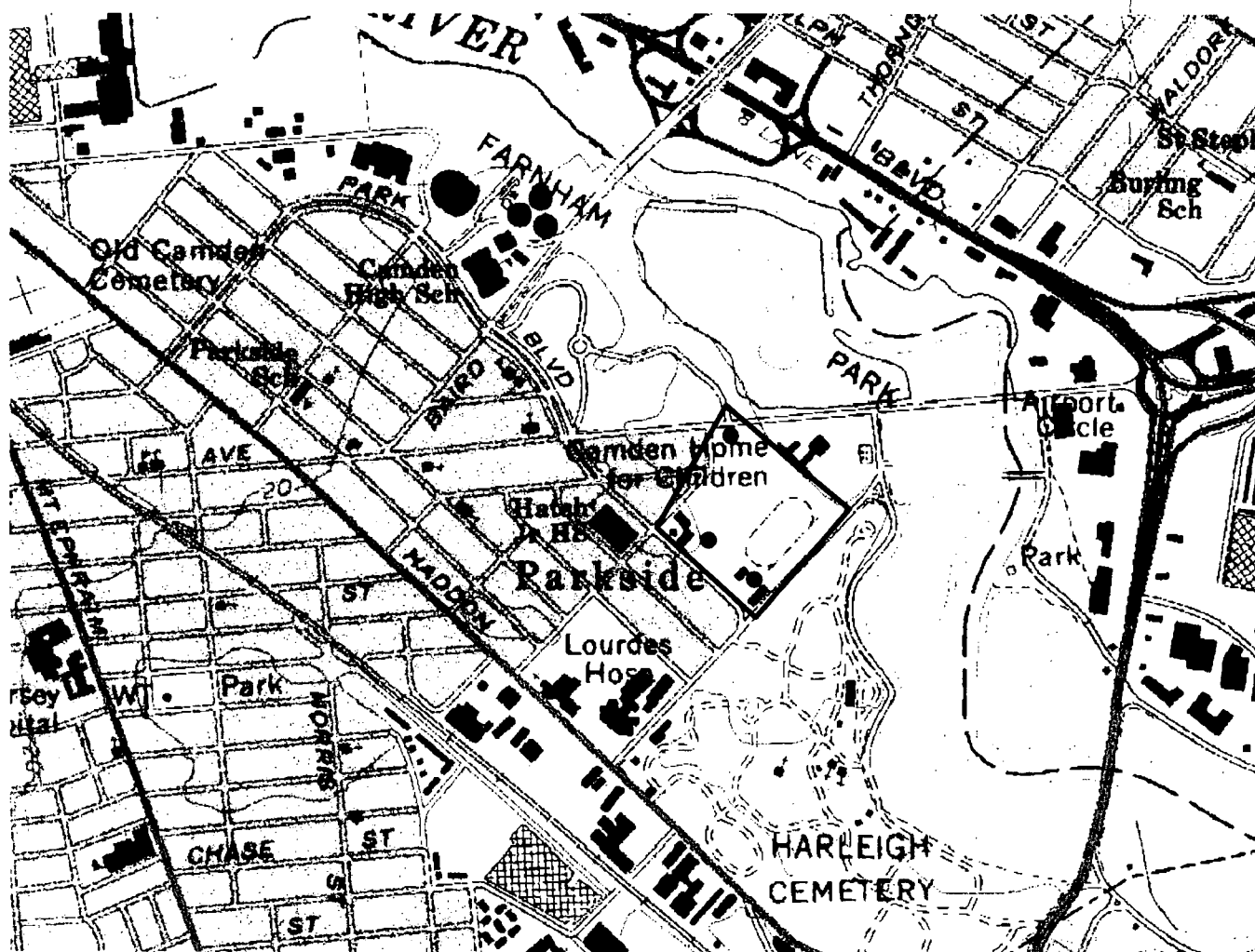
**Camden Northeast and Northwest
Quarter Quadrangles**



-  Delair Wellfield Boundary
-  Morris Wellfield Boundary
- Delair Well Locations
- Morris Well Locations

Attachment B
Well Location Map B1

1" = Approximately 1700'



**U.S. Geological Survey
Topographical Map
Camden Quadrangle, 1967
Photorevised 1984**



□ Parkside Wellfield Boundary
● Parkside Well Locations

Figure B2
Well Location Map

1" = Approximately 1150'

ATTACHMENT C
EPA/WESTON SAMPLING SOPs

REGION II

Attu

DATE: MAR 20 1998

SUBJECT: Final USEPA Region II Low Stress (Low Flow) Ground Water Sampling Standard Operating Procedure.

FROM: *Barbara A. Finazzo*
Barbara A. Finazzo, Director
Division of Environmental Science and Assessment

TO:
Kathleen C. Callahan, Director (DEPP)
Richard L. Caspe, Director (ERRD) ✓
Conrad Simon, Director (DECA)
Carl Soderberg, Director (CEPD)

REC-1
12/11/98

Attached for your information and distribution to your divisions, please find the USEPA Region II Low Stress (Low Flow) Ground Water Sampling Standard Operating Procedure (SOP). This SOP is now the standard method for collecting ground water samples for the Region.

In the majority of cases, low stress sampling has been demonstrated to result in samples which are more representative of nascent ground water quality. Samples collected using the low stress technique usually display lower turbidity, and, where present, higher concentrations of volatile compounds. Adoption of the low stress SOP is consistent with Region II's commitment to obtaining representative samples for purposes of characterization and decision making. However, it does not preclude use of other methods on a case by case basis.

We are in the process of developing a hands-on training for EPA and state personnel, and plan to make it available here in Edison this summer.

If you have any questions regarding these matters, please call me at (732) 321-6754, or have your staffs call Dennis McChesney at (732) 321-6729.

Attachment

cc. W. Muszynski, DRA, w/o attachment

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION II

GROUND WATER SAMPLING PROCEDURE
LOW STRESS (Low Flow) PURGING AND SAMPLING

I. SCOPE & APPLICATION

This Low Stress (or Low-Flow) Purging and Sampling Procedure is the EPA Region II standard method for collecting low stress (low flow) ground water samples from monitoring wells. Low stress Purging and Sampling results in collection of ground water samples from monitoring wells that are representative of ground water conditions in the geological formation. This is accomplished by minimizing stress on the geological formation and minimizing disturbance of sediment that has collected in the well. The procedure applies to monitoring wells that have an inner casing with a diameter of 2.0 inches or greater, and maximum screened intervals of ten feet unless multiple intervals are sampled. The procedure is appropriate for collection of ground water samples that will be analyzed for volatile and semi-volatile organic compounds (VOCs and SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals, and microbiological and other contaminants in association with all EPA programs.

This procedure does not address the collection of light or dense non-aqueous phase liquids (LNAPL or DNAPL) samples, and should be used for aqueous samples only. For sampling NAPLs, the reader is referred to the following EPA publications: DNAPL Site Evaluation (Cohen & Mercer 1993); and the RCRA Ground-Water Monitoring Draft Technical Guidance (EPA/530-R-93-001), and references therein.

II. METHOD SUMMARY

The purpose of the low stress purging and sampling procedure is to collect ground water samples from monitoring wells that are representative of ground water conditions in the geological formation. This is accomplished by setting the intake velocity of the sampling pump to a flow rate that limits drawdown inside the well casing.

Sampling at the prescribed (low) flow rate has three primary benefits. First, it minimizes disturbance of sediment in the bottom of the well, thereby producing a sample with low turbidity (i.e., low concentration of suspended particles). Typically, this saves time and analytical costs by eliminating the need for collecting and analyzing an additional filtered sample from the same well. Second, this procedure minimizes aeration of the ground water during sample collection, which improves the sample quality for VOC analysis. Third, in most cases the procedure significantly reduces the volume of ground water purged from a well and the costs associated with its proper treatment and disposal.

III. ADDRESSING POTENTIAL PROBLEMS

Problems that may be encountered using this technique include a) difficulty in sampling wells with insufficient yield; b) failure of one or more key indicator parameters to stabilize; c) cascading of water and/or formation of air bubbles in the tubing; and d) cross-contamination between wells.

Insufficient Yield

Wells with insufficient yield (i.e., low recharge rate of the well) may dewater during purging. Care should be taken to avoid loss of pressure in the tubing line due to dewatering of the well below the level of the pump's intake. Purging should be interrupted before the water level in the well drops below the top of the pump, as this may induce cascading of the sand pack. Pumping the well dry should therefore be avoided to the extent possible in all cases. Sampling should commence as soon as the volume in the well has recovered sufficiently to allow collection of samples. Alternatively, ground water samples may be obtained with techniques designed for the unsaturated zone, such as lysimeters.

Failure to Stabilize Key Indicator Parameters

If one or more key indicator parameters fails to stabilize after 4 hours, one of three options should be considered: a) continue purging in an attempt to achieve stabilization; b) discontinue purging, do not collect samples, and document attempts to reach stabilization in the

log book; c) discontinue purging, collect samples, and document attempts to reach stabilization in the log book; or d) Secure the well, purge and collect samples the next day (preferred). The key indicator parameter for samples to be analyzed for VOCs is dissolved oxygen. The key indicator parameter for all other samples is turbidity.

Cascading

To prevent cascading and/or air bubble formation in the tubing, care should be taken to ensure that the flow rate is sufficient to maintain pump suction. Minimize the length and diameter of tubing (i.e., 1/4 or 3/8 inch ID) to ensure that the tubing remains filled with ground water during sampling.

Cross-Contamination

To prevent cross-contamination between wells, it is strongly recommended that dedicated, in-place pumps be used. As an alternative, the potential for cross-contamination can be reduced by performing the more thorough "daily" decontamination procedures between sampling of each well in addition to the start of each sampling day (see Section VII, below).

Equipment Failure

Adequate equipment should be on-hand so that equipment failures do not adversely impact sampling activities.

IV. PLANNING DOCUMENTATION AND EQUIPMENT

- Approved site-specific Field Sampling Plan/Quality Assurance Project Plan (QAPP). This plan must specify the type of pump and other equipment to be used. The QAPP must also specify the depth to which the pump intake should be lowered in each well. Generally, the target depth will correspond to the mid-point of the most permeable zone in the screened interval. Borehole geologic and geophysical logs can be used to help select the most permeable zone. However, in some cases, other criteria may be used to select the target depth for the pump intake. In all cases, the target depth must be approved by the EPA hydrogeologist or EPA project scientist.

- ▶ Well construction data, location map, field data from last sampling event.
- ▶ Polyethylene sheeting.
- ▶ Flame Ionization Detector (FID) and Photo Ionization Detector (PID).
- ▶ Adjustable rate, positive displacement ground water sampling pump (e.g., centrifugal or bladder pumps constructed of stainless steel or Teflon). A peristaltic pump may only be used for inorganic sample collection.
- ▶ Interface probe or equivalent device for determining the presence or absence of NAPL.
- ▶ Teflon or Teflon-lined polyethylene tubing to collect samples for organic analysis. Teflon or Teflon-lined polyethylene, PVC, Tygon or polyethylene tubing to collect samples for inorganic analysis. Sufficient tubing of the appropriate material must be available so that each well has dedicated tubing.
- ▶ Water level measuring device, minimum 0.01 foot accuracy, (electronic preferred for tracking water level drawdown during all pumping operations).
- ▶ Flow measurement supplies (e.g., graduated cylinder and stop watch or in-line flow meter).
- ▶ Power source (generator, nitrogen tank, etc.).
- ▶ Monitoring instruments for indicator parameters. Eh and dissolved oxygen must be monitored in-line using an instrument with a continuous readout display. Specific conductance, pH, and temperature may be monitored either in-line or using separate probes. A nephelometer is used to measure turbidity.
- ▶ Decontamination supplies (see Section VII, below).
- ▶ Logbook (see Section VIII, below).

- ▶ Sample bottles.
- ▶ Sample preservation supplies (as required by the analytical methods).
- ▶ Sample tags or labels, chain of custody.

V. SAMPLING PROCEDURES

Pre-Sampling Activities

1. Start at the well known or believed to have the least contaminated ground water and proceed systematically to the well with the most contaminated ground water. Check the well, the lock, and the locking cap for damage or evidence of tampering. Record observations.
2. Lay out sheet of polyethylene for placement of monitoring and sampling equipment.
3. Measure VOCs at the rim of the unopened well with a PID and FID instrument and record the reading in the field log book.
4. Remove well cap.
5. Measure VOCs at the rim of the opened well with a PID and an FID instrument and record the reading in the field log book.
6. If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one. Note that the reference point should be surveyed for correction of ground water elevations to the mean geodesic datum (MSL).
7. Measure and record the depth to water (to 0.01 ft) in all wells to be sampled prior to purging. Care should be taken to minimize disturbance in the water column and dislodging of any particulate matter attached to the sides or settled at the bottom of the well.
8. If desired, measure and record the depth of any NAPLs using an interface probe. Care should be taken to minimize disturbance of

any sediment that has accumulated at the bottom of the well. Record the observations in the log book. If LNAPLs and/or DNAPLs are detected, install the pump at this time, as described in step 9, below. Allow the well to sit for several days between the measurement or sampling of any DNAPLs and the low-stress purging and sampling of the ground water.

Sampling Procedures

9. **Install Pump:** Slowly lower the pump, safety cable, tubing and electrical lines into the well to the depth specified for that well in the EPA-approved QAPP or a depth otherwise approved by the EPA hydrogeologist or EPA project scientist. The pump intake must be kept at least two (2) feet above the bottom of the well to prevent disturbance and resuspension of any sediment or NAPL present in the bottom of the well. Record the depth to which the pump is lowered.
10. **Measure Water Level:** Before starting the pump, measure the water level again with the pump in the well. Leave the water level measuring device in the well.
11. **Purge Well:** Start pumping the well at 200 to 500 milliliters per minute (ml/min). The water level should be monitored approximately every five minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 ft or less). Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. As noted above, care should be taken to maintain pump suction and to avoid entrainment of air in the tubing. Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment.
12. **Monitor Indicator Parameters:** During purging of the well, monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, Eh, and DO) approximately every five minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows (Puls and Barcelona, 1996):

- 0.1 for pH
- +3% for specific conductance (conductivity)
- +10 mv for redox potential
- +10% for DO and turbidity

Dissolved oxygen and turbidity usually require the longest time to achieve stabilization. The pump must not be removed from the well between purging and sampling.

13. Collect Samples: Collect samples at a flow rate between 100 and 250 ml/min and such that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 ft. VOC samples must be collected first and directly into sample containers. All sample containers should be filled with minimal turbulence by allowing the ground water to flow from the tubing gently down the inside of the container.

Ground water samples to be analyzed for volatile organic compounds (VOCs) require pH adjustment. The appropriate EPA Program Guidance should be consulted to determine whether pH adjustment is necessary. If pH adjustment is necessary for VOC sample preservation, the amount of acid to be added to each sample vial prior to sampling should be determined, drop by drop on a separate and equal volume of water (e.g., 40 ml). Ground water purged from the well prior to sampling can be used for this purpose.

14. Remove Pump and Tubing: After collection of the samples, the tubing, unless permanently installed, must be properly discarded or dedicated to the well for resampling by hanging the tubing inside the well.
15. Measure and record well depth.
16. Close and lock the well.

VI. FIELD QUALITY CONTROL SAMPLES

Quality control samples must be collected to determine if sample collection and handling procedures have adversely affected the quality of the ground water samples. The appropriate EPA Program Guidance

II

should be consulted in preparing the field QC sample requirements of the site-specific QAPP.

All field quality control samples must be prepared exactly as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples should be collected during the sampling event:

- ▶ Field duplicates
- ▶ Trip blanks for VOCs only
- ▶ Equipment blank (not necessary if equipment is dedicated to the well)

As noted above, ground water samples should be collected systematically from wells with the lowest level of contamination through to wells with highest level of contamination. The equipment blank should be collected after sampling from the most contaminated well.

VII. DECONTAMINATION

Non-disposable sampling equipment, including the pump and support cable and electrical wires which contact the sample, must be decontaminated thoroughly each day before use ("daily decon") and after each well is sampled ("between-well decon"). Dedicated, in-place pumps and tubing must be thoroughly decontaminated using "daily decon" procedures (see #17, below) prior to their initial use. For centrifugal pumps, it is strongly recommended that non-disposable sampling equipment, including the pump and support cable and electrical wires in contact with the sample, be decontaminated thoroughly each day before use ("daily decon").

EPA's field experience indicates that the life of centrifugal pumps may be extended by removing entrained grit. This also permits inspection and replacement of the cooling water in centrifugal pumps. All non-dedicated sampling equipment (pumps, tubing, etc.) must be decontaminated after each well is sampled ("between-well decon," see #16 below).

17. Daily Decon

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

D) Disassemble pump.

E) Wash pump parts: Place the disassembled parts of the pump into a deep basin containing 8 to 10 gallons of non-phosphate detergent solution. Scrub all pump parts with a test tube brush.

F) Rinse pump parts with potable water.

G) Rinse the following pump parts with distilled/ deionized water: inlet screen, the shaft, the suction interconnector, the motor lead assembly, and the stator housing.

H) Place impeller assembly in a large glass beaker and rinse with 1% nitric acid (HNO_3).

I) Rinse impeller assembly with potable water.

J) Place impeller assembly in a large glass beaker and rinse with isopropanol.

K) Rinse impeller assembly with distilled/deionized water.

13. Between-Well Decon

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

D) Final Rinse: Operate pump in a deep basin of distilled/deionized water to pump out 1 to 2 gallons of this final rinse water.

VIII. FIELD LOG BOOK

A field log book must be kept each time ground water monitoring activities are conducted in the field. The field log book should document the following:

- ▶ Well identification number and physical condition.
- ▶ Well depth, and measurement technique.
- ▶ Static water level depth, date, time, and measurement technique.
- ▶ Presence and thickness of immiscible liquid layers and detection method.
- ▶ Collection method for immiscible liquid layers.
- ▶ Pumping rate, drawdown, indicator parameters values, and clock time, at three to five minute intervals; calculate or measure total volume pumped.
- ▶ Well sampling sequence and time of sample collection.
- ▶ Types of sample bottles used and sample identification numbers.
- ▶ Preservatives used.
- ▶ Parameters requested for analysis.
- ▶ Field observations of sampling event.
- ▶ Name of sample collector(s).
- ▶ Weather conditions.
- ▶ QA/QC data for field instruments.

IX. REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation, C.K. Smoley Press, Boca Raton, Florida.

Puls, R.W. and M.J. Barcelona, 1996, Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures, EPA/640/S-95/504.

U.S. EPA, 1993, RCRA Ground-Water Monitoring: Draft Technical Guidance, EPA/530-R-93-001.

U.S. EPA Region II, 1989, CERCLA Quality Assurance Manual.

Puls, R.W. and M.J. Barcelona, 1996, Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures; EPA/540/S-95/504.

U.S. EPA, 1993, RCRA Ground-Water Monitoring: Draft Technical Guidance, EPA/530-R-93-001.

U.S. EPA Region II, 1989, CERCLA Quality Assurance Manual.



ROY F. WESTON, INC.
STANDARD PRACTICES MANUAL
COMPANY CONFIDENTIAL AND
PROPRIETARY INFORMATION

OPERATING PRACTICE
Potable Water Sampling

EH Date: 04/01/93 Initiated By: R.B. Biggs

Approved By: P.J. Marks

Authorized By: A.M. Henry

SP No.:

16-11-012

POTABLE WATER SAMPLING

THE APPROVAL SIGNATURES ARE KEPT ON FILE
WITH WESTON'S POLICIES AND PRACTICES GROUP
OF THE QUALITY ASSURANCE/FINANCE DIVISION

REVISION NUMBER: 00

Initiated by: D.L. Jones
R.B. Biggs
Legal Review: D.B. Bauer
Approved by: P.J. Marks
Authorized by: A.M. Henry

Important Notice:

This document has been prepared as a default procedure to assist Roy F. Weston, Inc. (WESTON) personnel with the performance of specific task and procedures when other guidance documents or regulatory procedures are not applicable or are non-existent. It is the sole responsibility of WESTON personnel performing procedures in this operating practice to determine if other guidance documents or regulatory procedures exist and are to be followed instead of or in conjunction with this operating practice. Other guidance or regulatory documents can include, but are not limited to Federal, State, and Local codes, policies, client or WESTON proposals, work plans, field sampling plans, quality assurance project plans, and any other applicable document. This document is not to be utilized by WESTON personnel as a substitute for thorough understanding of the subject matter or as a substitute for applicable training.

1.0 PURPOSE

Roy F. Weston, Inc. (WESTON) has adopted New Jersey Department of Environmental Protection and Energy (NJDEPE) standard for potable water sampling and domestic well sampling (see attachment).

2.0 INTERPRETATION

If there are questions regarding the interpretation or the applicability of items in this operating practice, the Project Manager or Technical Manager should be consulted. In the absence of either of those, contact your Section Manager.

3.0 REFERENCES

New Jersey Department of Environmental Protection and Energy (NJDEPE) Field Sampling Procedures Manual, May 1992, pages 181-186.

h. Sampling Domestic Wells

(See also, J. "POTABLE WATER SAMPLING" -
2. "INDIVIDUAL WATER SUPPLY SYSTEMS")

An important step in sampling a domestic well is to obtain as much information as possible from the homeowner. This should include: depth of the well, well yield, formation in which the well is completed, screen depth and length, well construction material, diameter of casing and when and by whom the well was installed. This information should be verified if possible by obtaining drilling logs, etc. With this information, determine the number of gallons to be evacuated (see section 5. "Sampling Procedures" b. "Field Measurements").

When collecting a sample from an operating domestic well, it is essential to evacuate the plumbing and water storage tank. Running the water for a minimum of fifteen minutes before collection is a good rule of thumb, however, longer is desirable. Listen for the pump or the electric circuit to the pump to come on, indicating that the plumbing is being evacuated. Inquire as to whether any treatment units are installed on the system. Softening, iron removal, turbidity removal, disinfection, pH adjustment are often used; these may give misleading analyses depending on the parameters of interest. Home carbon filters for the removal of organics are also increasingly popular. Basement and outside faucets may by-pass such treated water (note: sample cold water faucet).

A brief inspection of the system should be performed to locate the well, pump, storage tanks and any treatment systems. Samples should be taken as close to the pumping well as possible and prior to any storage tanks or treatment systems. If a sample must be taken following a treatment unit, the type, size and purpose of the unit should be noted on samples sheets and in the field logbook.

Home faucets, particularly kitchen faucets, usually have a screen installed on the discharge. The screen must be removed prior to sampling for bacteria, or for volatile organics, since the screen tends to aerate the water and some organics may be lost. Also, when sampling for bacteria, do not take a sample from a swivel faucet since the joint may harbor a significant bacterial population.

Note: Homeowners' plumbing systems should not be tampered with in any way, except for removal of the faucet screen with permission of the homeowner.

For long term monitoring projects which utilize domestic wells, a specific tap or faucet should be designated as the target sample access point for accurate reproducibility of future samples.

i. Sampling Industrial Wells

When sampling industrial wells, it is desirable to sample as close to the well source as possible. Samples should be taken directly from the well head whenever possible. This will eliminate treatment interferences, possible changes in quality within the lines, mixing of water from other wells, etc.

Large capacity wells which are "on-line" during the visit can be sampled immediately. Wells which are "off-line", must be pumped to waste prior to sampling. Fifteen minutes or more is suggested. Access to municipal well systems well houses, etc. requires the assistance of a water department employee. Prior notification is essential.

I. SAMPLING OF MUNICIPAL AND INDUSTRIAL WASTEWATERS

Sampling of municipal and industrial wastewaters is performed for a number of reasons: to determine compliance with Federal, State or local standards, to

verify reported self-monitoring data, to assist in determining discharger or user fees based upon wastewater strength, to verify the sampling technique and monitoring points of regulated parties, and to aid in determining the sources of prohibited or unwanted wastes. The most difficult type of sampling to perform is the collection of background information for future use; sometimes the correct information will be obtained, sometimes it will be missed. The collection of background information is critical. Information that may be gathered includes flow, totalizer readings, pH, TSS, treatment plant configuration and operating status.

When sampling wastewaters, one must take into consideration that good sample results are dependent on a number of factors, including sample representativeness, proper sampling technique and proper preservation. A location for sample collection should be chosen where uniform wastewater quality and thorough mixing exist. Wastewater influent samples should be collected at a point prior to any recycle, supernatant or return lines; wastewater effluent samples should be collected after the final treatment process. Take into consideration that the representativeness of samples may depend on timing; for example, influent samples collected at a municipal treatment plant with a substantial collection system may represent discharges into the system that occurred hours ago. In addition, be cognizant that many sampling locations present safety hazards, ranging from confined spaces, heights, unsteady equipment or surroundings, to airborne pollutants, biological hazards that may include infectious disease agents, ticks, poison ivy and snakes to chemical hazards such as corrosive liquids, heavy metals and potentially explosive atmospheres.

Samples may be collected as grabs or composites, depending on the purpose of the sampling, regulatory requirements or site conditions. Grab samples are single samples collected at neither a set time or flow. It may be advantageous to collect grab samples if wastewater flow is not continuous, if the wastewater's character varies or is not consistent, or if there is a need or desire to determine if a composite sample of the wastewater would obscure extreme conditions of the waste. In addition, some parameters, specifically dissolved oxygen or other dissolved gases, total and fecal coliform and other bacteria, pH, temperature, oil and grease and petroleum hydrocarbons, purgeable organics, and available and residual chlorine sulfite may only be collected as grab samples.

Composite samples may be collected in six different manners depending on sample volumes collected and at what frequency sample collection occurs. Composite samples may be collected as follows: constant sample volume/consistent time intervals, constant sample volume/time interval between samples is proportional to wastewater flow, constant time intervals/sample volume is proportional to the wastewater flow rate at the time of sample collection, constant time interval/sample volume is proportional to total wastewater flow since the last sample was collected; continuous sample collection or pumping rate, and continuous sample rate is proportional to wastewater flow. If flow rates at the time of sample collection are within (+/-) fifteen percent of the average flow, sample compositing based on constant sample volumes and constant time intervals is generally representative, however, the method is not considered to be the most representative for highly variable flow or concentration conditions. During sample compositing, a minimum of eight individual samples should be collected, if at all possible, and each individual aliquot should be a minimum of 100 milliliters. During six hour composites, a facility should collect an aliquot at least once each half hour.

Composite sampling may be conducted manually or by the use of an automatic sampler. The most common automatic samplers use either a vacuum pump or a peristaltic pump to draw the sample into the unit. A unit with a vacuum pump may be able to draw the sample at a higher velocity and from a cross-section of the wastestream, however it may also bias the solids concentration in the collected sample if the unit in use operates by filling a reservoir and then wasting excess sample material before draining the remainder to the sample container. A unit with a peristaltic pump discharges a measured sample volume into the sample container, so less solids separation and associated sample bias should occur. However, peristaltic pump units generally sample from only one point in the wastestream. Automatic samplers operating with a suction lift and without a detachable gathering system are practically limited to operation at heads at or under 25 feet due to internal friction losses and atmospheric pressure. Automatic samplers should be capable of rapidly purging the intake system prior to and immediately after collection of an aliquot. The transport lines for the units should also be at least 0.64 centimeters (0.25 inches) in diameter to prevent clogging. It should be recognized that the transport lines may build up growths which may periodically slough off and contaminate sample material if left uncleaned or unnoticed. Samplers should have an intake velocity of between two and five feet (0.6 to 1.5

meters) per second. Units with an intake velocity under two feet per second may leave solids behind in the tubing, while those with intake velocities over this range may draw in large pieces of suspended material; either case may yield erratic analytical results. One reference consulted recommended determining the suspended solids concentrations obtained from an automatic sampler and comparing it with a mean of a minimum of six simultaneously collected manual grab samples. The obtained ratio (automatic:grab) for a municipal treatment plant influent should be 1.6 to 2.0 and for a municipal treatment plant effluent should be 0.9 to 1.3. Samples should be kept near 4° C during compositing; if the sampler does not have an integrated refrigeration unit or ice compartment, it may be placed on ice in an ice chest that has been laid on its end. Standard Methods for the Examination of Water and Wastewater recommends the addition of chemical preservatives at the start of composite sample collection, so that all sample portions are preserved as soon as they are collected.

Units to be used for collecting samples to be analyzed for trace organics must be free of Tygon tubing, which may be a source of phthalate ester contamination, and of other sources of contamination such as plastic or rubber compounds. The collection of a field blank must include the automatic sampling equipment.

When sampling wastewater, any equipment coming in contact with the sample material must be clean (see Chapter 2). It is preferable to collect samples directly into the containers in which they will be submitted for analysis, if at all possible. If a bucket or sampling device is to be used for collecting samples that will be analyzed for metals, do not use a metal device. Some parameters, such as oil and grease, petroleum hydrocarbons, volatile organics, and base neutral/acid extractable organics should not be collected except in the final sample container, if at all possible. Any device or bottle coming into contact with the sample material should be rinsed with the liquid two or three times, unless the bottle is pre-preserved, contains a dechlorinating agent, has been rinsed with acid, acetone, or hexane, or unless the sample is to be analyzed for oil and grease, petroleum hydrocarbons or for microbiological parameters. Sampling devices should face upstream, and samples should be collected centrally (at a 0.4 to 0.6 depth from the bottom of the wastestream and in the center of the channel). Collecting samples at this depth avoids skimming the surface of the wastestream, where the concentration of lighter-than-water materials will be highest, and lowers the possibility of sampling bed

loads in situations where solids separation is a concern.

When sampling from a valve or a faucet, flush the sampling line first, taking into consideration the line diameter, length of pipe to be flushed and velocity of flow. When sampling wastestreams that are under pressure, regulate the flow rate in the sampling line to not less than 500 milliliters per minute after first flushing the line at a rate high enough to remove sediment and gas pockets. If it is believed that dissolved gases will be released from solution due to the drop in pressure, a notation should be made. If samples are to be collected from a wastestream that is at an elevated temperature, they must be collected through a cooling coil.

The importance of the use of proper containers and proper sampling and preservation techniques cannot be overly stressed. A material with a pH of 6.5 standard units, or less, and a low buffer capacity may experience a significant pH change if shaken. In addition, samples stored in plastic containers may experience a change in pH due to the permeability of the container walls to gases like carbon dioxide. With a change in the carbon dioxide, pH, and alkalinity balance, calcium carbonate may precipitate out and the concentrations of total hardness and calcium may drop. A change in the concentrations of carbon dioxide and dissolved oxygen and in pH and temperature may change the concentrations of inorganic parameters such as manganese, iron, alkalinity and hardness. If air contact will change the concentration or characteristics of a constituent, it is recommended that the sample bottle be completely filled and secured from air contact. If the sample will require mixing, if the sample will be completely consumed during analysis (such as oil and grease and petroleum hydrocarbons), or if microbiological parameters are to be analyzed, the bottle will not be able to be completely filled. If a preservative has already been added to the bottle, do not overfill the container. Containers should be completely filled for the following analyses: purgeable organics, hydrogen sulfide, free and residual chlorine, pH, hardness, ammonia, dissolved oxygen and oxygen demands, sulfite, acidity, alkalinity, ferrous iron, and for most organics. For samples requiring shipment, allow a one to ten percent airspace for thermal expansion except VO, BOS and DO. This airspace will most likely not compensate for accidental sample freezing, however.

Microbiological activity may be responsible for changes in the nitrate/nitrite/ammonia concentrations of a

wastewater, may reduce phenol concentration, may cause the reduction of sulfate to sulfide, reduce biochemical oxygen demand, and reduce residual chlorine to chloride. Due to oxidation, sulfite, sulfide, iodide, cyanide and ferrous iron concentrations may decrease. Hexavalent chromium may be reduced to chromic ion. Color, odor and turbidity may change in quality. Silica, sodium and boron may be leached out of glass containers. Some cations may be lost by adsorption onto, or in ion exchange with, the glass walls of sample containers.

Individuals who are required to chose dilutions for biochemical oxygen demand or coliform bacteria analyses, may find the following tables to be helpful:

Suggested Biochemical Oxygen Demand Dilutions

Sample Type	Dilutions
Raw Sewage	1-2-5X
Secondary Effluent	5-10-25X or 2-5-10X
Tertiary Effluent	5-10-25X

Suggested Coliform Dilutions

Sample Type	Dilutions
Raw Sewage	10 ⁻⁴ , 10 ⁻⁵ , 10 ⁻⁶
Disinfected Effluent	1, 10 ⁻¹ , 10 ⁻²

Dilutions	MPN Range	
10, 1, 10 ⁻¹	2.0	1,600
1, 10 ⁻¹ , 10 ⁻²	20	16,000
10 ⁻¹ , 10 ⁻² , 10 ⁻³	200	160,000
10 ⁻² , 10 ⁻³ , 10 ⁻⁴	2,000	1,600,000
10 ⁻³ , 10 ⁻⁴ , 10 ⁻⁵	20,000	16,000,000
10 ⁻⁴ , 10 ⁻⁵ , 10 ⁻⁶	200,000	160,000,000

J. POTABLE WATER SAMPLING

1. PUBLIC COMMUNITY WATER SYSTEM: DEFINITION

A system for provision to the public of piped water for human consumption, if such system has at least 15 service connections, or regularly serve at least 25 individuals at least 60 days out of the year.

a. Source (Raw water) Sample

i. Ground Water

Samples from a well supply should be collected as close to the well head as possible (before any treatment) preferably from a designated raw water sample tap. The sampler is cautioned to remember that well pumps and casings can contribute to sample contamination. If a well pump has not run for an extended period of time prior to sampling, the water collected may not be representative of actual water quality. The sample may be collected immediately (after flushing the sample tap) if the well has been running continuously. If the pump has turned off or is running intermittently, run the pump for a minimum of 30 minutes.

ii. Surface Water

Samples collected from a surface water supply are to be collected before the water receives any treatment and should be representative of the water entering the intake structure. The actual sampling location might be after the low lift pumps or at the intake structure. This sample is NOT to be collected along the banks of a river, lake, or reservoir.

b. Plant Delivered (Finished Water) Sample

This sample is to be collected at a location following all water treatment and is to be representative of the finished product leaving the treatment facility. Only proper spigots are to be used and they must be flushed prior to sampling.

c. Point of Entry Sample

This sample is to be collected at a point of entry into the water distribution system representative of a particular source after the application of any treatment.

In many cases this may be a plant delivered sample (if no other sample tap is available) or a meter pit sample tap where water bulk purchased from another water supply enters a distribution system.

d. System Sample

A system sample is a sample collected from the water distribution system. A FIRST DRAW sample is water that

immediately comes out when a tap is first opened. This type of sample is useful when evaluating whether plumbing materials are contributing lead or other contaminants to the water supply. A FLUSHED SAMPLE is collected after the piping has been evacuated and should be representative of the water flowing in the public water main.

When collecting a FLUSHED sample, allow the spigot to run long enough to obtain a representative sample. A good rule-of-thumb is to allow the water to flow until the water in the service line (the pipe that carries tap water from the public water main to a home or building) has been replaced at least twice. A convenient flow for sampling is usually about a half-gallon per minute. (to estimate flow, use a gallon jug and watch it fill. For a flow of a half-gallon per minute, the jug should be half full in one minute or completely full in two minutes). Since 50 feet of 3/4 inch service line pipe contains over one gallon (3.8 liters), 4 or 5 minutes of running time would be necessary to replace the water in the line twice.

Samples should not normally be collected from fire hydrants, drinking fountains, or from spigots that contain aerators or screens. If aerators or screens are present, they should be removed with care. Do not sample from taps that are surrounded by excessive foliage (leaves, flowers) or taps that are dirty, corroded, or are leaking. Never collect a sample from a hose or any other attachment to a faucet. Be sure that the sample container does not touch the faucet.

2. INDIVIDUAL WATER SUPPLY SYSTEMS (PUBLIC NON-COMMUNITY/NON-PUBLIC/DOMESTIC WELLS)

An important step when sampling these types of supplies is to conduct an initial survey to get a general overview of the water system and its operation, and how the configuration of the system relates to the type of sample (raw water, finished/treated water, or an intermediate sampling point) that you want to collect. Some important considerations are:

- Well driller and date drilled
- Construction of well and casing depth
- Well and pump location
- Well depth and pump capacity (if available)
- Storage tank capacity
- Treatment or conditioning units (if any)
- Plumbing arrangement
- Possible sample collection points
- Distance of well to any septic systems or underground storage tanks

Prior to sampling an individual water supply system it is essential to evacuate all standing water from the well, storage tank, and plumbing (unless a first draw sample is desired - See "System Sample"). A good rule-of-thumb is to flush for 15 minutes prior to sampling. Listen for the pump to turn on. This is a good indicator that the tank and plumbing are being evacuated. Opening additional faucets, flushing toilets, etc., will use more water and shorten the waiting time.

Should a raw water sample be desired, sample as close to the well head as possible and prior to the storage tank or any treatment system. Sometimes basement or outside faucets may be the best sampling point for this type of sample.

If the kitchen faucet is used, the aerator should be removed (for more information see H 5.h. Sampling Domestic Wells).

Measurement of the thickness of the floating layer may be accomplished by using a water indicator paste/gel with a weighted steel tape to determine the depth to the top of the floating layer and to the water surface. The difference between these two readings is the thickness of the floating layer. Measurement of the thickness of the floating layer may also be accomplished by using an interface probe or clear Teflon bailer, if the product thickness is less than the length of the bailer. Electric water level sounders will not work properly for these determinations.

Prior to the purging of ground water from the well, a sample of the floating layer may be obtained using a bailer which fills from the bottom. Care should be taken to lower the bailer just through the floating layer but not significantly down into the underlying ground water. Samples should be analyzed to determine the chemical composition of the LNAPL and its physical properties (e.g., specific gravity, water solubility, equilibrium vapor pressure of the liquid and Henry's Law Constant, etc.). After following typical evacuation procedures discussed previously in this section, a sample of formation water may be obtained from the well.

g. Sampling for Dense, Non-Aqueous Phase Liquids (DNAPLs)

DNAPLs include chlorinated solvents and other chemicals which have specific gravities greater than water. They are likely to be present in aquifers as a separate phase because of low solubility in water. DNAPL chemicals tend to migrate downward through the unsaturated zone and the saturated zone due to their high density. If the volume of DNAPL chemical introduced into the subsurface is larger than the retention capacity of the vadose and saturated zones, a portion of the DNAPL will spread out as a layer of free liquid on the bottom of the aquifer or on lower permeability beds within the aquifer.

Measurement of the thickness of DNAPLs (and LNAPLs) must be performed prior to purging (evacuating) the well. Measurement of the DNAPL may be accomplished by using a water indicator paste/gel with a weighted steel tape (if no LNAPL is present) to determine the depth of the top of the DNAPL and the bottom of the well. The difference between these two measurements is the thickness of the DNAPL in the well. An interface probe may also be used to measure DNAPL in the well. An interface probe may also be used to measure DNAPL

thickness.

Prior to purging a monitor well, a sample of the DNAPL may be obtained using a dual check valve bailer or a bladder pump. If both LNAPLs and DNAPLs are present in a well it may be necessary to purge the well of one casing volume of water prior to sampling the DNAPL provided that efforts are made not to disturb the DNAPL in the bottom of the well. This can be accomplished by setting the pump intake of the submersible or suction-lift pump several feet above the DNAPL.

Samples should be analyzed to determine the chemical composition of the DNAPL and its physical properties (e.g., specific gravity, water solubility, equilibrium vapor pressure of the liquid and Henry's Law Constant, etc.). After the well is purged, a sample of the ground water may be obtained for laboratory analysis.

h. Sampling Domestic Wells

(See also, J. "POTABLE WATER SAMPLING" -
2. "INDIVIDUAL WATER SUPPLY SYSTEMS")

An important step in sampling a domestic well is to obtain as much information as possible from the homeowner. This should include: depth of the well, well yield, formation in which the well is completed, screen depth and length, well construction material, diameter of casing and when and by whom the well was installed. This information should be verified if possible by obtaining drilling logs, etc. With this information, determine the number of gallons to be evacuated (see section 5. "Sampling Procedures" b. "Field Measurements").

When collecting a sample from an operating domestic well, it is essential to evacuate the plumbing and water storage tank. Running the water for a minimum of fifteen minutes before collection is a good rule of thumb, however, longer is desirable. Listen for the pump or the electric circuit to the pump to come on, indicating that the plumbing is being evacuated. Inquire as to whether any treatment units are installed on the system. Softening, iron removal, turbidity removal, disinfection, pH adjustment are often used; these may give misleading analyses depending on the parameters of interest. Home carbon filters for the removal of organics are also increasingly popular. Basement and outside faucets may by-pass such treated water (note: sample cold water faucet).

Prior to sampling an individual water supply system it is essential to evacuate all standing water from the pipes, storage tank, and plumbing (unless a first draw sample is desired - See "System Sample"). A good rule-of-thumb is to flush for 15 minutes prior to sampling. Listen for the pump to turn on. This is a good indicator that the tank and plumbing are being evacuated. Opening additional faucets, flushing toilets, etc., will use more water and shorten the waiting time.

Should a raw water sample be desired, sample as close to the well head as possible and prior to the storage tank or any treatment system. Sometimes basement or outside faucets may be the best sampling point for this type of sample.

If the kitchen faucet is used, the aerator should be removed (for more information see H 5.h. Sampling Domestic Wells).

K. BIOLOGICAL

1. PHYTOPLANKTON SAMPLING

a. Sample Site Location

Locate sampling stations as near as possible to those selected for chemical and bacteriological sampling to ensure maximum correlation of findings. These locations will depend upon the physical nature of the water body. In streams or rivers, stations should be established both upstream and downstream of a pollution source or major tributary. Stations should also be set up on either side of the river so as to account for unequal lateral mixing. Slow moving sections of streams generally contain more phytoplankton than slower moving segments. If there are any lakes, reservoirs, or backwater areas (i.e., potential phytoplankton sources) upstream of sampling stations, notes on their nature and location should be included in the sampling log.

Sampling stations in lakes, reservoirs, estuaries and the ocean should be located along grid networks or transect lines, aligned so as to provide the most representative sampling. Points of interest should include intake and discharge areas, constrictions within the water body, and major bays and tributaries off of the main basin. In tidal areas, the effects of tidal oscillation should also be taken into account

when determining sampling frequency. When locating stations for a "red tide" survey in estuarine or coastal waters, note where and when the blooms tend to occur.

b. Sampling Depth

Rivers, streams, shallow bays and coastal waters are usually well mixed so that only subsurface sampling is necessary. In lakes, reservoirs, as well as deeper coastal waters, plankton composition and density may vary with depth; thus sampling should be done at several depths determined by the depth of the thermocline, the euphotic zone if applicable, and overall the depth at the station. In shallow areas (1-2 meters) subsurface samples (to a depth of 1M) are usually sufficient. In deeper lakes and reservoirs, samples should be taken at intervals of 5M or less to the thermocline. In estuarine and coastal waters 2-10M deep, subsurface, mid-depth and near bottom samples are recommended. Offshore, in marine waters, samples should be collected at intervals of 5M or less to the bottom of the thermocline, and near the bottom where depletion of oxygen by decaying blooms is critical; larger sample volumes of at least one liter are needed because these waters are typically low in productivity.

c. Sampling Procedure

Sample size, preservation and storage is dependent upon certain variables. Refer to Appendix 2-1 for details.

If analysis is limited to species composition clear polyethylene or glass bottles may be used. If chlorophyll analyses is requested, amber bottles are recommended. Clear or translucent glass or plastic bottles may be used provided they are covered with aluminum foil so as to shield out light.

Freshwater samples for species composition analysis should be preserved with a solution of neutralized formalin (5 ml neutralized buffer with formalin/100 ml of sample); estuarine and marine samples are to be preserved with Lugol's solution (60 g KI + 40 g iodine crystals in 1,000 ml distilled water) at a rate of one (1) drop Lugol's solution to 100 ml of sample adding more periodically to maintain the color of weak tea. In special studies glutaraldehyde may be used (6 drops/25 ml of sample). All preserved samples should be stored in the dark immediately so as to prevent the degradation of the phytoplankton, or the preservative if Lugol's solution is used.



SAMPLING EQUIPMENT DECONTAMINATION

SOP#: 2006
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1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure

water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. An acid rinse provides a low pH media for trace metals removal and is included in the decontamination process if metal samples are to be collected. It is followed by another distilled/deionized water rinse. If sample analysis does not include metals, the acid rinse step can be omitted. Next, a high purity solvent rinse is performed for trace organics removal if organics are a concern at the site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. Acetone is typically chosen because it is an excellent solvent, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern at a given site or if Target Compound List analysis (which includes acetone) is to be performed, another solvent may be substituted. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

The decontamination procedure described above may be summarized as follows:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. 10% nitric acid rinse
6. Distilled/deionized water rinse
7. Solvent rinse (pesticide grade)
8. Air dry
9. Distilled/deionized water rinse

If a particular contaminant fraction is not present at the site, the nine (9) step decontamination procedure specified above may be modified for site specificity. For example, the nitric acid rinse may be eliminated if metals are not of concern at a site. Similarly, the solvent rinse may be eliminated if organics are not of

concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest.

More specifically, sample collection and analysis of decontamination waste may be required before beginning proper disposal of decontamination liquids and solids generated at a site. This should be determined prior to initiation of site activities.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

- C The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free (specifically for the contaminants of concern).
- C The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.
- C If acids or solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.
- C Damage can be incurred by acid and solvent washing of complex and sophisticated sampling equipment.

5.0 EQUIPMENT/APPARATUS

Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-bristle scrub brushes or long-handled bottle brushes can be used to remove contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children's wading pools can

also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

5.1 Decontamination Solutions

- C Non-phosphate detergent
- C Selected solvents (acetone, hexane, nitric acid, etc.)
- C Tap water
- C Distilled or deionized water

5.2 Decontamination Tools/Supplies

- C Long and short handled brushes
- C Bottle brushes
- C Drop cloth/plastic sheeting
- C Paper towels
- C Plastic or galvanized tubs or buckets
- C Pressurized sprayers (H₂O)
- C Solvent sprayers
- C Aluminum foil

5.3 Health and Safety Equipment

Appropriate personal protective equipment (i.e., safety glasses or splash shield, appropriate gloves, aprons or coveralls, respirator, emergency eye wash)

5.4 Waste Disposal

- C Trash bags
- C Trash containers
- C 55-gallon drums
- C Metal/plastic buckets/containers for storage and disposal of decontamination solutions

6.0 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions. Table 1 (Appendix A) lists solvent rinses which may be required for elimination of particular chemicals. In general, the following solvents are typically utilized for decontamination purposes:

- C 10% nitric acid is typically used for inorganic compounds such as metals. An acid rinse may not be required if inorganics are not a contaminant of concern.
- C Acetone (pesticide grade)⁽¹⁾
- C Hexane (pesticide grade)⁽¹⁾
- C Methanol⁽¹⁾

⁽¹⁾ - Only if sample is to be analyzed for organics.

7.0 PROCEDURES

As part of the health and safety plan, a decontamination plan should be developed and reviewed. The decontamination line should be set up before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- C The number, location, and layout of decontamination stations.
- C Decontamination equipment needed.
- C Appropriate decontamination methods.
- C Methods for disposal of contaminated clothing, equipment, and solutions.
- C Procedures can be established to minimize the potential for contamination. This may include: (1) work practices that minimize contact with potential contaminants; (2) using remote sampling techniques; (3) covering monitoring and sampling equipment with plastic, aluminum foil, or other protective material; (4) watering down dusty areas; (5) avoiding laying down equipment in areas of obvious contamination; and (6) use of disposable sampling equipment.

7.1 Decontamination Methods

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. Various decontamination methods will remove contaminants by: (1) flushing or other physical action, or (2) chemical complexing to inactivate contaminants by neutralization, chemical reaction, disinfection, or sterilization.

Physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods, as follows:

7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The mechanical abrasive cleaning methods are most commonly used at hazardous waste sites. The following abrasive methods are available:

Mechanical

Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, time of application, and angle at which the abrasive strikes the surface will dictate cleaning efficiency. Disadvantages of this method are the inability to control the amount of material removed and the large amount of waste generated.

Wet Blasting

Wet blast cleaning involves use of a suspended fine abrasive. The abrasive/water mixture is delivered by compressed air to the contaminated area. By using a very fine abrasive, the amount of materials removed can be carefully controlled.

7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with pressure. In general, the equipment surface is not removed using non-abrasive methods.

Low-Pressure Water

This method consists of a container which is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high-pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow rates usually range from 20 to 140 liters per minute.

Ultra-High-Pressure Water

This system produces a water jet that is pressured from 1,000 to 4,000 atmospheres. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 meters/second (m/s) (1,000 atm) to 900 m/s (4,000 atm). Additives can be used to enhance the cleaning action.

Rinsing

Contaminants are removed by rinsing through dilution, physical attraction, and solubilization.

Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps hooked on a fence, placed on a drum, or wrapped in plastic bags are not likely to become heavily contaminated. A damp cloth should be used to wipe off contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set.

Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment. This method of decontamination is typically performed off-site.

7.2 Field Sampling Equipment Decontamination Procedures

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. The spread of contaminants is further reduced by separating each

decontamination station by a minimum of three (3) feet. Ideally, the contamination should decrease as the equipment progresses from one station to another farther along in the line.

A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC) which is in the CRZ. Figure 1 (Appendix B) shows a typical contaminant reduction zone layout. The CRC controls access into and out of the exclusion zone and confines decontamination activities to a limited area. The CRC boundaries should be conspicuously marked. The far end is the hotline, the boundary between the exclusion zone and the contamination reduction zone. The size of the decontamination corridor depends on the number of stations in the decontamination process, overall dimensions of the work zones, and amount of space available at the site. Whenever possible, it should be a straight line.

Anyone in the CRC should be wearing the level of protection designated for the decontamination crew. Another corridor may be required for the entry and exit of heavy equipment. Sampling and monitoring equipment and sampling supplies are all maintained outside of the CRC. Personnel don their equipment away from the CRC and enter the exclusion zone through a separate access control point at the hotline. One person (or more) dedicated to decontaminating equipment is recommended.

7.2.1 Decontamination Setup

Starting with the most contaminated station, the decontamination setup should be as follows:

Station 1: Segregate Equipment Drop

Place plastic sheeting on the ground (Figure 2, Appendix B). Size will depend on amount of equipment to be decontaminated. Provide containers lined with plastic if equipment is to be segregated. Segregation may be required if sensitive equipment or mildly contaminated equipment is used at the same time as equipment which is likely to be heavily contaminated.

Station 2: Physical Removal With A High-Pressure

Washer (Optional)

As indicated in 7.1.2, a high-pressure wash may be required for compounds which are difficult to remove by washing with brushes. The elevated temperature of the water from the high-pressure washers is excellent at removing greasy/oily compounds. High pressure washers require water and electricity.

A decontamination pad may be required for the high-pressure wash area. An example of a wash pad may consist of an approximately 1 1/2 foot-deep basin lined with plastic sheeting and sloped to a sump at one corner. A layer of sand can be placed over the plastic and the basin is filled with gravel or shell. The sump is also lined with visqueen and a barrel is placed in the hole to prevent collapse. A sump pump is used to remove the water from the sump for transfer into a drum.

Typically heavy machinery is decontaminated at the end of the day unless site sampling requires that the machinery be decontaminated frequently. A separate decontamination pad may be required for heavy equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Prior to setting up Station 3, place plastic sheeting on the ground to cover areas under Station 3 through Station 10.

Fill a wash basin, a large bucket, or child's swimming pool with non-phosphate detergent and tap water. Several bottle and bristle brushes to physically remove contamination should be dedicated to this station. Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 4: Water Basin

Fill a wash basin, a large bucket, or child's swimming pool with tap water. Several bottle and bristle brushes should be dedicated to this station. Approximately 10-50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 5: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to contain the water during the rinsing process. Approximately 10-20 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 6: Nitric Acid Sprayers

Fill a spray bottle with 10% nitric acid. An acid rinse may not be required if inorganics are not a contaminant of concern. The amount of acid will depend on the amount of equipment to be decontaminated. Provide a 5-gallon bucket or basin to collect acid during the rinsing process.

Station 7: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 8: Organic Solvent Sprayers

Fill a spray bottle with an organic solvent. After each solvent rinse, the equipment should be rinsed with distilled/deionized water and air dried. Amount of solvent will depend on the amount of equipment to decontaminate. Provide a 5-gallon bucket or basin to collect the solvent during the rinsing process.

Solvent rinses may not be required unless organics are a contaminant of concern, and may be eliminated from the station sequence.

Station 9: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 10: Clean Equipment Drop

Lay a clean piece of plastic sheeting over the bottom plastic layer. This will allow easy removal of the plastic in the event that it becomes dirty. Provide aluminum foil, plastic, or other protective material to wrap clean equipment.

7.2.2 Decontamination Procedures

Station 1: Segregate Equipment Drop

Deposit equipment used on-site (i.e., tools, sampling devices and containers, monitoring instruments radios, clipboards, etc.) on the plastic drop cloth/sheet or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination. Loose leaf sampling data sheets or maps can be placed in plastic zip lock bags if contamination is evident.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

Use high pressure wash on grossly contaminated equipment. Do not use high- pressure wash on sensitive or non-waterproof equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Scrub equipment with soap and water using bottle and bristle brushes. Only sensitive equipment (i.e., radios, air monitoring and sampling equipment) which is waterproof should be washed. Equipment which is not waterproof should have plastic bags removed and wiped down with a damp cloth. Acids and organic rinses may also ruin sensitive equipment. Consult the manufacturers for recommended decontamination solutions.

Station 4: Equipment Rinse

Wash soap off of equipment with water by immersing the equipment in the water while brushing. Repeat as many times as necessary.

Station 5: Low-Pressure Rinse

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 6: Nitric Acid Sprayers (required only if metals are a contaminant of concern)

Using a spray bottle rinse sampling equipment with nitric acid. Begin spraying (inside and outside) at one end of the equipment allowing the acid to drip to the other end into a 5-gallon bucket. A rinsate blank may be required at this station. Refer to Section 9.

Station 7: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 8: Organic Solvent Sprayers

Rinse sampling equipment with a solvent. Begin spraying (inside and outside) at one end of the equipment allowing the solvent to drip to the other end into a 5-gallon bucket. Allow the solvent to evaporate from the equipment before going to the next station. A QC rinsate sample may be required at this station.

Station 9: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure washer.

Station 10: Clean Equipment Drop

Lay clean equipment on plastic sheeting. Once air dried, wrap sampling equipment with aluminum foil, plastic, or other protective material.

7.2.3 Post Decontamination Procedures

1. Collect high-pressure pad and heavy equipment decontamination area liquid and waste and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the Department of Transportation (DOT) requirements for appropriate containers based on the contaminant of concern.
2. Collect high-pressure pad and heavy equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
3. Empty soap and water liquid wastes from basins and buckets and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
4. Empty acid rinse waste and place in appropriate container or neutralize with a base and place in appropriate drum. pH paper or an equivalent pH test is required for

neutralization. Consult DOT requirements for appropriate drum for acid rinse waste.

5. Empty solvent rinse sprayer and solvent waste into an appropriate container. Consult DOT requirements for appropriate drum for solvent rinse waste.
6. Using low-pressure sprayers, rinse basins, and brushes. Place liquid generated from this process into the wash water rinse container.
7. Empty low-pressure sprayer water onto the ground.
8. Place all solid waste materials generated from the decontamination area (i.e., gloves and plastic sheeting, etc.) in an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
9. Write appropriate labels for waste and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum generated from the decontamination process.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

A rinsate blank is one specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field.

Rinsate blanks are samples obtained by running analyte free water over decontaminated sampling equipment to test for residual contamination. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identical to samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Where dedicated sampling equipment is

not utilized, collect one rinsate blank per day per type of sampling device samples to meet QA2 and QA3 objectives.

If sampling equipment requires the use of plastic tubing it should be disposed of as contaminated and replaced with clean tubing before additional sampling occurs.

10.0 DATA VALIDATION

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the project's data quality objectives.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow OSHA, U.S. EPA, corporate, and other applicable health and safety procedures.

Decontamination can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before use. Decontamination materials may degrade protective clothing or equipment; some solvents can permeate protective clothing. If decontamination materials do pose a health hazard, measures should be taken to protect personnel or substitutions should be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process.

Safety considerations should be addressed when using abrasive and non-abrasive decontamination equipment. Maximum air pressure produced by abrasive equipment could cause physical injury. Displaced material requires control mechanisms.

Material generated from decontamination activities requires proper handling, storage, and disposal. Personal Protective Equipment may be required for these activities.

Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e., acetone, alcohol, and trisodiumphosphate).

In some jurisdictions, phosphate containing detergents (i.e., TSP) are banned.

12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, February, 1988.

A Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February, 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October, 1985.

APPENDIX A

Table

Table 1. Soluble Contaminants and Recommended Solvent Rinse

<p style="text-align: center;">TABLE 1 Soluble Contaminants and Recommended Solvent Rinse</p>		
SOLVENT⁽¹⁾	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Tap water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Nitric acid Acetic acid Boric acid	Basic (caustic) compounds (e.g., amines and hydrazines)
Dilute Bases	Sodium bicarbonate (e.g., soap detergent)	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents ⁽²⁾	Alcohols Ethers Ketones Aromatics Straight chain alkalines (e.g., hexane) Common petroleum products (e.g., fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent ⁽²⁾	Hexane	PCBs

⁽¹⁾ - Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

⁽²⁾ - WARNING: Some organic solvents can permeate and/or degrade the protective clothing